

CIWMB

Emerging Technologies Forum

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Update on New York City's Efforts

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New York City

- Population 8.2 million and growing
- Commuters from four states; 1.3 million/day
- Density, little undeveloped land
- SE corner of State
- No local disposal capacity
- 2217 Census districts – 636 High density, 989 medium, 592 low

Regulatory constraints

- NYC not meeting CAA for Ozone, PM 2.5
- State law closed City's landfill, terminated certain WTE projects in City
- City law already closed apartment house incinerators

NYC Solid Waste

- 12,000 tpd DSNY post-recycling PSW
- 7000 tpd Commercial post-recycling PSW
- 2500 tpd Residential Recyclables: Paper, Metal, Glass, Plastics
- 2800 tpd Other Recyclables- asphalt, scrap cars, etc.
- Total 52,000 TPD waste of all kinds

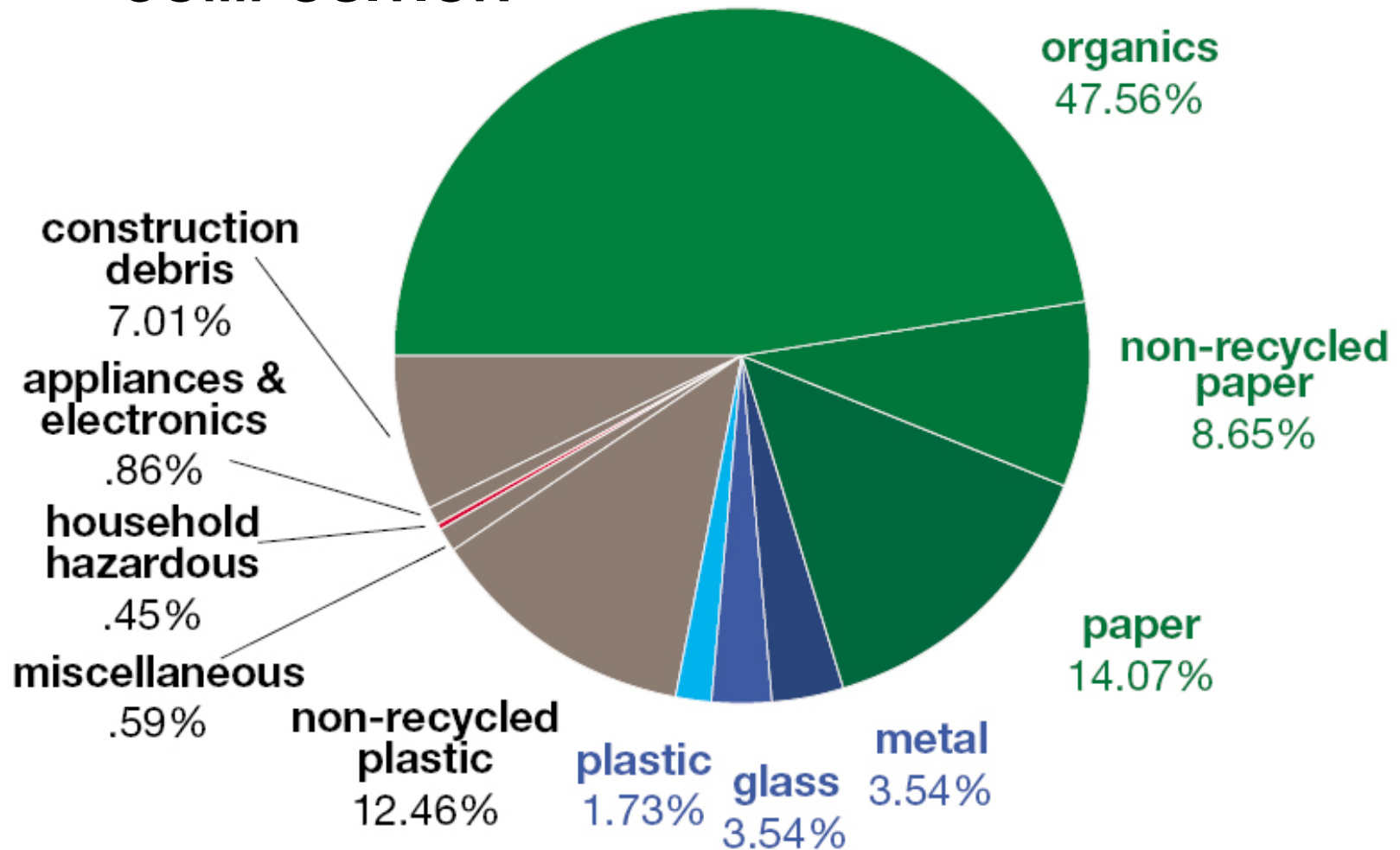
NYC Solid Waste

- Commercial C&D 9,000; Fill 19,000 tpd
- DSNY Curbside 18-20%; City-managed 33%; Total recycling 69% including
 - C&D recycling, Clean fill, Biosolids.
- Recycling mandatory
- Dual-compartment Paper and MGP in 22 of 59 districts

DSNY Operations

- 3.6 million tons of DSNY MSW in FY'05
- 6,375 Street miles
- 2,230 collection trucks and EZ Packs
- 3 million households
- 2-3 pickups/week
- Recycling weekly pickup

NYC RESIDENTIAL WASTE COMPOSITION



Current Disposal

- 15% of 12,000 tpd to regional WTE
- 85% by truck and rail to private landfills in NY State and 6 others
- City MSW - 70 million vehicle miles traveled to disposal
- 48% of waste exported from City via trailer; VMTs will decline

Why NYC is Considering Conversion

- City Plan allows for flexibility and new technologies
- Cost savings
- Potential value in waste
- Proximity
- Sustainability

Cost

- Disposal cost with local landfill \$45/ton
- Latest \$90/ton, going to \$107 under Plan - \$400 million/yr
- Local/regional facilities would offer proximity, other benefits

Recover more value from MSW: Energy/Economic Development

- NYC needs energy: 2,600Mw by 2008
- City policy favors recycling, economic development from waste stream
- Constraints on more recycling by HH
- City has been pioneer in waste management
 - First WTE in 1879
 - First WPCP plant

Sustainability

- Mayor's Sustainability Taskforce
- Long-term strategic planning
- Commitment to pursue Kyoto GG reductions
- RGGI compact
- NYC - coastal city
- DSNY pursuing cleaner trucks, energy from landfill, reduced VMTs

Evaluation of New and Emerging Solid Waste Management Technologies

- Phase 1 Study
- Published Sept 16, 2004
- Conducted by Alternative Resources, Inc. (ARI) of Concord, MA

First Stage of ARI Phase 1 Study

- 43 technologies considered
- No WTE or RDF processes
- No aerobic composting of MSW
- Screening criteria:
 - “New and emerging”?
 - Sufficient information?
- 33 technologies reviewed in second stage

Second Stage of Phase 1

- 20 Thermal
- 6 Anaerobic digestion
- One Thermal/AD
- One new Aerobic Digestion
- 3 Hydrolysis
- One Chemical
- One Mechanical - fiber recovery

Thermal Processes

- Use heat to convert (but not incinerate) waste
 - *Gasification*
 - *Pyrolysis*
 - *Cracking*
 - *Plasma*
- Produce Syngas, char, organic liquids (light HC)

Digestion (Aerobic/Anaerobic)

- Microbes reduce organic fraction
 - *Anaerobic* - produces biogas and compost
 - *Aerobic* - produces compost for soil amendment/fertilizer

Hydrolysis

- Acid-catalyzed reaction of cellulose fraction with water to produce sugars
- Sugars ferment to alcohol (*Ethanol*) and/or *Levulinic Acid*
- Byproduct *lignin* biomass may produce energy
- Masada OxyNol permitted in NY State

Chemical Processing

- One technology studied
- Based on *Depolymerization* – breakdown of large molecules into simpler compounds.
- Converts organics to energy, oil, specialty chemicals, carbon solids

Mechanical Processing

- Process MSW to recover fiber for use in paper making.
- includes innovative refuse-derived fuel technologies that produce a clean source of secondary fiber.

Criteria for Step 2 review

- Readiness – commercial in 10 years
- Size – 50,000 tpy minimum (137 tpd)
- Reliability – pilot or commercial facility
- Environmental performance – meet NY State and NYC regulations
- Beneficial Use of Waste – energy/ products
- Residual Waste – less than 35% by weight of incoming

Screening results for Step 2

- 14 of 33 passed 2nd level
- Thermal
- Anaerobic Digestion
- One Hydrolysis

Anaerobic Digestion

- Arrow Ecology & Engineering
- Canada Composting
- Orgaworld
- Organic Waste Systems
- Waste Recovery Systems

Thermal

- Ebara
- GEM America
- Global Energy Solutions
- Interstate Waste Technologies
- Rigel Resource Recovery & Conversion
- Solena Group
- Startech Environmental

Hydrolysis

- Masada OxyNol
- Biofine

Step 3: Compare Technologies

14 Technologies Compared – factors:

- Readiness and reliability – commercial?
- Facility size and design flexibility
 - wide range of throughputs?
 - Limits on inputs?
- Utilization of Existing NYC Collection System

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- Facility siting – acreage, other
 - Utility needs
 - Quantity/quality of residuals for disposal
 - Environmental impacts – air, water, noise, odor, traffic, aesthetic

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- Public acceptability
 - Cost – design & build, O&M, tip fee
 - Economic Development potential
 - Experience & resources of sponsor
 - Develop, site, permit, finance, design, build, operate; market output
 - Develop publicly- or privately-owned
 - Risk profile

Phase 1 Study Results-Sept 2004

Anaerobic Digestion, Thermal Processing, and Acid Hydrolysis could serve New York City “with suitable project definition and risk sharing between public and private sponsor.”

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- *If private sponsor unwilling to assume risk, City might do pilot*
 - *Do more focused review of AD and Thermal*

Compared to WTE:

- Thermal technologies can also be large (1,500 tpd facility); WTE 3000 tpd
- Anaerobic Digestion: 700-800 tpd
- WTE better on experience, throughput
- AD and Thermal better on emissions, residuals, and public acceptance
- Comparable to WTE on cost

ARI Phase 2 Study

- NYC engaged ARI to do follow up
- Study in draft; to be released soon

ARI Phase 2 – 2005 to present

- Technical
- Environmental
- Economic
- 14 Companies considered

Phase 2 Study

Anaerobic Digestion

- Arrow Ecology & Engineering
- Canada Composting
- Orgaworld
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Phase 2 Study

Thermal

- Ebara
- GEM America
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Phase 2 Study

- *2 Hydrolysis*
 - Masada OxyNol
 - Biofine

Phase 2 Study

- Questionnaires
- Talk with operators, regulators, clients
- Meetings
- Data verification
 - Mass and energy balances
 - Emissions
 - Record of performance

Phase 2, Step 2

9 Firms met criteria for more study:

Anaerobic Digestion - 4

Thermal Gasification- 4

Hydrolysis -1

Phase 2, Step 2, cont.

Hydrolysis: -from Permit and EIS

Masada OxyNol – (Waste to Ethanol)

- 230,000 tpy wet MSW
- 422,000 tpy sewage sludge
- 32,000 tpy waste paper
- Total input 684,364 tpy
- Produce up to 7.1M Gal. ethanol, recyclables, gypsum, CO₂
- Tip fee \$65/ton in 2004

Additional technology

Mechanical Processing – Fiber Recovery

- World Waste Technologies

- Facility in Anaheim, CA under construction
- 500 tpd residuals from MRF
- Autoclave to sterilize, then wetlap from cellulose pulp for cardboard production

Phase 2 Study - parameters

- Assumed 8 years to start up
- Looked at DBO and DBOO over 20 yrs
- Technology presentations July '05
- Marketability of outputs evaluated
- Construction and operating costs

Limitations of Phase 2

- No Environmental Life Cycle analysis
- Data limited by nature of study
- No new source separation
- No peer review
- No ranking of results
- No consideration of specific sites in NYC

Next Steps

- Report expected Summer '06
- Assist in determining if next step should be facility development
- Decision whether to incorporate into City long term plans, when & how
- If favorable, need education process for siting effort

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